SSVEO IFA List **Date:02/27/2003**

STS - 46, OV - 104, Atlantis (12) **Time:04:14:PM**

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:00:01:11.989	Problem	**FIAR**	**IFA** STS-46-V-01	MPS
BSTR-01	**GMT:** 213:13:58:00.000		**SPR** 46RF01	**UA**	**Manager:**
			IPR TBDV-0002	**PR**	
					Engineer:

Title: ME-GH2 Flow Control Pressure Anomaly (ORB)

Summary: DISCUSSION: During ascent, between 91 to 108 seconds mission elapsed time (MET), the main engine (ME)-3 GH2 flow control valve (FCV) inlet pressure exhibited pressure spikes of up to 60 psi above the baseline pressure of 3100 psia. During this time period and throughout the remainder of the engine run, the ME-3 FCV remained open. GH2 disconnect pressure data downstream of the FCV assembly was erratic during the same time period confirming the anomaly to be flow-related and not due to instrumentation. The erratic pressure and flowrate did not affect pressurization of the LH2 tank.

An analysis of flight data indicates that the pressure spikes are flowrate-related. Failure analysis has included removal of the FCV poppet/sleeve assembly and a borescope inspection of the FCV body and near-field upstream and downstream lines. The poppet/sleeve assembly was sent to Rockwell/Downey for inspection, which included looking for indications of contamination and performing dimensional checks. These inspections identified no obvious cause of the anomaly. The assembly was then sent to the vendor and a flow balance test was performed without the spring to verify poppet force balance and sensitivity to downstream pressure. The results of the flow test were suspect with the poppet exhibiting a tendency to move back towards the low flow position without the FCV being commanded to that position. However, with the spring installed, the net force should have been positive, keeping the poppet in the high-flow position. The flow test was done with GN2 and utilizing GH2 in the test to better simulate the mass flow of GH2 is being considered. In addition, the engine isolation check valve (CV 23), located upstream of thr ME-3 FCV, was removed and a visual inspection of the inlet and outlet ports has revealed no evidence of contamination. Complete disassembly and inspections of CV 23 is in work. CONCLUSION: The pressure spikes seen in the GH2 pressurization system are caused by changes in system flowrate. The inspections/testing performed have failed to identify a conclusive cause of the flowrate changes. The most probable cause is transient contamination in th FCV annular orifice. CORRECTIVE_ACTION: The ME-3 FCV poppet/sleeve assembly has been removed and inspected and it will be replaced. Also, CV 23 was removed and replaced. The failure analysis is being tracked on CAR 46RF01. EFFECTS_ON_SUBSEQUENT_MISSIONS: None. Recurrence of the anomaly in the pressure range seen is not a concern. The worst case failure of a totally blocked flow control valve can be compensated for by the remaining two flow control valves.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:07:03:11.989	Problem	**FIAR**	**IFA** STS-46-V-02A	INST
EECOM-05	**GMT:** 213:21:00:00.000		**SPR** 46RF02	**UA**	**Manager:**
			IPR TBDV-0010	**PR**	
					Engineer:

Title: Body Flap Lower Skin Temperature Transducer Erratic (ORB)

Summary: DISCUSSION: The body flap skin temperature measurement (V09T1026A) sensor exhibited erratic temperature drops. The measurement indicated off-scale-low (-200?F) several times during the mission.

CONCLUSION: Postflight troubleshooting and data analysis confirmed that the sensor had failed. CORRECTIVE_ACTION: The sensor will be removed and replaced. The surface mount type sensor was certified by similarity/analysis to the same type sensors that were used in other programs (Saturn S-II). It was decided at that time that additonal testing would not be cost effective and that the most cost effective approach would be to repair or replace as required. This sensor is bonded to the surface and is destroyed upon removal. Therefore, failure analysis is not required. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 007:23:15:01.989	Problem	**FIAR**	**IFA** STS-46-V-02B	INST
	GMT: 221:13:11:50.000		**SPR** 46RF02	**UA**	**Manager:**
			IPR TBDV-0010	**PR**	
					Engineer:

Title: Right main landing gear brake return line temperature (V58T0192A) dropped off-scale low. (ORB)

Summary: DISCUSSION: At main landing gear touchdown, the right main landing gear brake return line temperature (V58T0192A) dropped off scale low. Although not currently being used, this sensor can be used as one of the several temperature control sensors for activation of the system 1 hydraulic circulation pump.

CONCLUSION: The temperature sensor is bonded to the line. There have been occasions where the bond has failed on this type of installation. It is suspected that the bond has failed. The SODB requires all hydraulic temperatures downstream of the brake isolation valves to be above -20 F prior to entry. Until the right main landing gear brake return line temperature sensor is repaired, the left main landing gear brake return line temperature sensor (V58T0296A) can be used to estimate the right main landing gear return line temperature. Also, the off-scale low reading on the right main landing gear return line temperature sensor is greater than the modified FDA temperature limit and the circulation pump activation temperature assuring that no inadvertent FDA alert or circulation pump activation is caused by this problem. CORRECTIVE_ACTION: Troubleshooting and repair will be performed during OMDP on an opportunity basis. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:22:33:11.989	Problem	**FIAR** JSC EE-0670F	**IFA** STS-46-V-03	GFE
INCO-02	**GMT:** 214:12:30:00.000		**SPR**	**UA**	**Manager:**
			IPR	**PR** COM-4-13-0124	
					Engineer:

Title: Flight Deck Speaker Inoperable (GFE)

Summary: DISCUSSION: In-flight, the crew reported that the flight deck speaker was inoperative. The audio portion of the speaker had been working nominally and then stopped working altogether on flight day 2. The circuit breaker was cycled five times and the speaker power was also cycled several times by the crew in an attempt to regain proper speaker operation, but without success. The speaker remained inoperable for the remainder of the flight. This was the first flight of the redesigned speaker unit on OV-104. The first flight of the new design was OV-105 (STS-49). The speaker has been removed from the Orbiter and sent to JSC for troubleshooting.

CONCLUSION: Troubleshooting isolated the speaker problem to a short between the voltage regulator body and the heat-sink board in the speaker unit. The voltage regulator functions such that a short will shut the unit down. The source of the short was three small metal filings that punched through the insulator pad. The filings were trapped either between the heat-sink board and the insulator pad or between the insulator pad and the voltage regulator. The filings remained from the fabrication stage of the speaker. CORRECTIVE_ACTION: To prevent a short of this type in the future, a heavier insulation pad will be installed. There are 10 units currently at JSC that will receive this modification. The modification will not be available for implementation on STS-47, but should be ready for subsequent flights. The units removed from the Orbiter will be sent to JSC for modification and used as training units. EFFECTS_ON_SUBSEQUENT_MISSIONS: None. Several other means of communications are available, such as the wireless communications system (if flown) and any headset/headset interface unit (hardline), should this failure recur.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 001:06:35:11.989	Problem	**FIAR**	**IFA** STS-46-V-04	ECLSS
EECOM-01	**GMT:** 214:20:32:00.000		**SPR** 46RF03	**UA**	**Manager:**
			IPR	**PR** ECL-4-13-0549	
					Engineer:

Title: Avionics Bay 2A Smoke Detector Negative Excursions (ORB)

Summary: DISCUSSION: At 214:20:32 G.m.t., the avionics bay 2 smoke detector A concentration measurement (V62Q0608A) dropped to as low as -700 micrograms per cubic meter for eight minutes before recovering to normal levels (approximately 0). During the next 16 hours, this measurement exhibited 5 more drop/recovery cycles of similar magnitude. After these cycles, no further smoke concentration drops were experienced for the remainder of the flight. Since a negative smoke concentration is a

meaningless number, and the concentration drops were transient and recoverable, the sensor was still considered functional for detecting smoke. No troubleshooting activity was attempted during flight. None of the other smoke detectors on this flight exhibited anomalous behavior.

A self-test of the avionics bay 2A smoke detector was performed postflight at KSC with no anomalies noted. CONCLUSION: The cause of the negative excursions in the avionics bay 2A measured smoke concentrations is unknown. The behavior is transient, recoverable, and the sensor is considered adequate to detect actual smoke concentrations. In the worst case, if the sensor should fail completely, a redundant smoke sensor is available in avionics bay 2. CORRECTIVE_ACTION: None. Fly-as-is. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:00:13:11.989	Problem	**FIAR**	**IFA** STS-46-V-05	MPS
BSTR-02	**GMT:** 213:14:10:00.000		**SPR** 46RF06	**UA**	**Manager:**
			IPR TBDV-0003	**PR** MPS-4-13-0928	
					Engineer:

Title: GO2 Manifold Pressure Decay (ORB)

Summary: DISCUSSION: During and following the main propulsion system (MPS) dump, the GO2 pressurization system, as measured at the GO2 disconnect (V41P1590A), failed to repressurize and then decayed faster than normal. These data indicated an obvious GO2 pressurization system leak for which there were several potential sources. An indication of a leak was also present at entry when the GO2 pressurization system did not show the typical increase in pressure.

Postflight data analysis indicated that the most likely cause of the anomaly was leakage of the main engine (ME)-3 isolation check valve (CV 20). Troubleshooting included performance of a GO2 pressurization system decay rate test as well as leak tests of each engine isolation check valve. During the reverse leak test of CV 20, it was found to have out-of-specification leakage. The leakage, which should have been no more than 100 scim, was measured to be approximately 200 scim. Although the decay rate seen during flight would suggest a more severe leak, it is likely that either the entry repressurization or the performance of the reverse leak test of CV 20 tended to reseat the poppet and reduce the leak rate that was seen following the MPS dump. Leak testing identified no problems with the ME-1 and ME-2 isolation check valves (CV 18 and 19). CV 20 was removed and replaced and returned to the vendor for failure analysis. Inspections have included checks for contamination and failed parts. CV 20 was disassembled and significant contamination was visible in the outlet side of the valve. The majority (90 percent) of the contamination was metallic (Inconel 718) and the particles ranged in size from 1 to 400 microns. Most of the particles were in the 50- to 100-micron size range with 3 or 4 up to 400 microns. Some of the particles had molydisulfide (dry lube) on them which is used in the engine isolation check valves and the GO2 flow control valves (FCVs). Inconel 718 is prevalent throughout the GO2 pressurization system. Particle impact ignition is not a concern for the size and type of particles identified in CV 20. Inspections have been unable to identify a source of the contamination. An inspection of CV 20 showed no signs of the contamination being self-generated with only minor wear being found on the poppet seat. A

borescope inspection of the line downstream of CV 20 found it to be clean. A visual inspection of ME-3 has been conducted which included an inspection of the ME-3 anti-flood valve (AFV). Contamination was not found during these ME-3 inspections. Although unlikely, system generated sources cannot be eliminated since it is possible that contamination generated downstream of CV 20 could have been blown back through or came from the GO2 FCV during prepressurization. Further remedial actions regarding hardware inspections are not recommended. A system blowdown is not recommended since flight flow rates, which are significantly greater than blowdown flow rates, have provided the best cleaning purge available short of disassembly and inspection. CONCLUSION: Postflight troubleshooting identified the cause of the anomaly as leakage of the ME-3 isolation check valve (CV 20) due to contamination. Troubleshooting has included the inspection of CV 20, a borescope inspection of the line downstream of CV 20, a visual inspection of ME-3, and an inspection of the ME-3 AFV filter. None of these inspections have identified a source of the contamination. CORRECTIVE_ACTION: The ME-3 isolation check valve (CV 20) was removed and replaced. CV 20 was returned to the vendor for failure analysis, the results of which are being tracked on CAR 46RF03. EFFECTS_ON_SUBSEQUENT_MISSIONS: None. The function of an engine isolation check valve is not a concern for a nominal mission. The only concern would be a minor loss of helium during entry. The engine isolation check valves prevent GO2 reverse flow through the engine after an uncontained engine shutdown.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 002:15:26:11.989	Problem	**FIAR**	**IFA** STS-46-V-06	ECLSS
EECOM-03	**GMT:** 216:05:23:00.000		**SPR** 46RF04	**UA**	**Manager:**
			IPR None.	**PR**	
					Engineer:

Title: Fan Separator 1 Stalled (ORB)

Summary: DISCUSSION: At 216:05:24:23 G.m.t., (02:15:27:35 MET), the WCS fan separator 1 was turned on and demanded high currents on ac bus 1, a condition that is indicative of a stalled motor. The high demand caused the fan separator circuit breakers to open. Preliminary assessment of the problem indicated that the fan separator was flooded. In an attempt to regain fan separator 1 operation, the fan separator circuit breakers were reset and fan separator 1 was restarted at 216:06:49:06 G.m.t. The fan separator cleared temporarily, but within one minute, stall currents were again observed. The crew was instructed to perform an in-flight maintenance (IFM) procedure to clear fan separator 1 by venting the system overboard through the waste water dump nozzle. As the IFM was being performed, but prior to the dump valve being opened, fan separator 1 cleared and began to operate properly. After approximately 6.5 hours of satisfactory operation, fan separator 1 was unsuccessful. Fan separator 2 was selected for the remainder of the mission. A review of waste data during the IFM's and fan separator 1 operations indicated that the primary cause of the stalling appeared to be a mechanical problem.

After the flight, the WCS was removed fron the vehicle and sent to the vendor. The separator operated satisfactorily during bench testing, however, a noisy bearing was noted. Inspection of the bearing revealed that it had solid debris trapped around it. CONCLUSION: Repetition of the stalling problem was not possible postflight. However, the most likely cause of the flight problem was an intermittent seizing of the contaminated bearing. The debris found around the bearing was the result of a

flooding. CORRECTIVE_ACTION: The fan separator was cleaned and the bearings removed and replaced as part of normal turnaround. The fan separator was successsfully retested per acceptance test procedures, and returned to the inventory. A sticker is being made to remind crew members to allow the fan separator to continue to run for 30 seconds after each use to preclude potential flooding. Future modifications of the fan separator to prevent flooding will include a timer to automatically allow the fan separator to continue to run for 30 seconds after each use. The failure mode of this new system is such that if it fails, the operations prior to the modification will be used. This will be implemented early next year. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR** A. BFCE 029-F062	**IFA** STS-46-V-07	GFE
INCO-04	**GMT:**		B. DR BH230301	**UA**	**Manager:**
			SPR	**PR**	
			IPR		**Engineer:**

Title: A. AIU-C Channel 1 FailureB. AIU-D Performance was Intermittent (GFE)

Summary: DISCUSSION: A. The crew reported that the signals could be received, but not transmitted on audio interface unit (AIU)-C channel 1. Several crew remote units (CRU) were tried, but none were able to transmit from AIU-C channel 1.

B. During Postflight debriefings, the crew reported that the performance of audio interface unit (AIU)-D was intermittent. However, the crew did not isolate this anomaly and was unsure whether the AIU was the problem or the problem was related to the low-battery beeping tone that was ongoing throughout the flight on the crew remote units (CRU). CONCLUSION: A. Troubleshooting at JSC isolated the AIU-C failure to the transmit synthesizer. The synthesizer was replaced and the unit now functions properly. B. Troubleshooting at JSC did not reveal a problem with AIU-D. Functional tests verified that AIU-D operates properly. The most probable cause was the low-battery beeping problems which are documented by in-flight anomaly STS-46-V-08. CORRECTIVE_ACTION: A. Further troubleshooting will be performed on the synthsizer and tracked by Failure Investigation Action Report (FIAR) BFCE 029-F062. The AIU's for the next flight have been tested, and all are functional. B. Because of the uncertainty of this failure and the lack of information given as to the anomaly itself, no further troubleshooting will occur on this unit. The unit is functioning properly. EFFECTS_ON_SUBSEQUENT_MISSIONS: None. Three AIU's are flown on the Orbiter for five crewmember missions and five AIU's are flown on the Orbiter for seven crewmember missions. The crew has the option of manifesting a spare unit on each flight. If these anomalies recur, the crew could use the spare channel (2 channel per AIU). However, if both channels failed, the crew can then use either the spare unit (if manifested), a hand-held microphone, or the hardline mode.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 002:01:22:11.989	Problem	**FIAR** DR BH230291	**IFA** STS-46-V-08	GFE
INCO-03	**GMT:** 215:15:19:00.000		**SPR**	**UA**	**Manager:**
			IPR None	**PR**	

Engineer:

Title: Wireless Communication System Crew Remote Unit Low Battery Beep Tone (GFE)

Summary: DISCUSSION: The crew received the low-voltage warning beeping tome from the radio in the crew remote unit (CRU) after a limited operational time on a fresh battery, and at times, as soon as a fresh battery was attached. An internal customized integrated circuit determines the voltage at which the beeping tone occurs. The low-voltage range is 6.2 +/- 0.325V for the radio. A fresh fully operational battery has an initial voltage of 8.4V. Some of the batteries are exhibiting an initial voltage within the low-voltage range. The battery problems are in work by the battery community. However, until the batteries can provide the proper voltages, a change to the CRU's is being tested to eliminate the beeping tone. A surface-mounted microchip provides the beeping tone and also controls the volume. Changing the trigger voltage for the beeping tone requires modifying or replacing the particular chip. This can only be performed by the chip vendor.

CONCLUSION: The CRU's low-voltage warning beeping tone was designed to long-life batteries which supply initial voltages of 8.4V. The batteries are not supplying the required voltage levels and the beeping is being annunciated. CORRECTIVE_ACTION: The wireless communicatons system engineering community is attempting to eliminate the beeping tone by removing the voltage divider network. Quick testing verified that this fix will eliminate the tone, but a functional test will be required to ensure no damage occurs to the hardware. EFFECTS_ON_SUBSEQUENT_MISSIONS: None. The CRU's are functioning per design. Steps are being taken to eliminate the low battery voltage beeping tone. The beeping tone will not be disconnected to support STS-47. The CRU's next manifested mission will be STS-55. Several other means of communications are available, such as hand-held microphones, the launch/entry suit communications carrier assembly (a hardline which may be used to backup the wireless communications system) or any other headset/headset interface unit, should this problem recur.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 003:13:55:11.989	Problem	**FIAR**	**IFA** STS-46-V-09	OMS
PROP-01	**GMT:** 217:03:52:00.000		**SPR** 46RF05	**UA**	**Manager:**
			IPR TBDV-0007	**PR**	

Engineer:

Title: ROMS GN2 Pressure Valve Indicates Open (ORB)

Summary: DISCUSSION: At 217:03:52 G.m.t., the right orbital maneuvering system (OMS) GN2 pressurization valve position indication (V45X5552X) went from "closed" to "open" without the valve being commanded. The crew confirmed that the right OMS ARM/PRESS switch was in the "open" position. A review of GN2 tank pressure data indicated that the valve had not actually opened.

At 217:13:13 G.m.t., the right OMS pressurization valve switch was cycled from "off" to "arm/press" and then back to "off" again. Upon taking the switch back to the "off" position, the valve position indicator correctly showed that the valve was closed. The valve position indication anomaly did not recur during the remainder of the flight. CONCLUSION: The most probable cause of the anomaly is metallic particulate contamination across the position indicator microswitch. The microswitch would have been in the "open" position prior to the anomaly with no signal being forwarded to the multiplexer/demultiplexer (MDM). Contamination could have migrated into position to cause the anomaly and was then cleared with the valve cycle. A failure of MDM flight-aft 4 (FA 4) is considered to be highly unlikely. An MDM discrete input card failure can "set" a bit to an upper or lower limit. This condition can be self-curing or can be cleared by a power cycle of the MDM, with self-curing being the least likely. A state change of the data source has not previously cleared this type of anomaly. MDM FA 4 has no failure history in its 17 flights. CORRECTIVE_ACTION: Troubleshooting consisted of cycling the GN2 pressurization valve several times and the anomaly did not recur. The GN2 pressurization valve will be removed and replaced and returned to the vendor for failure analysis. Results of the failure analysis will be tracked under CAR 46RF05. EFFECTS_ON_SUBSEQUENT_MISSIONS: None. Position indication for this valve is criticality 3.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 003:13:03:11.989	Problem	**FIAR**	**IFA** STS-46-V-10	C&T
INCO-05	**GMT:** 217:03:00:00.000		**SPR** 46RF08	**UA**	**Manager:**
			IPR TBD-V0005	**PR**	
					Engineer:

Title: Overmodulation of Ku-Band Channel 3 (Loss of Ku-Band Channel 2 OPS Recorder Data) (ORB)

Summary: DISCUSSION: During STS-46, intermittent distortion of the return link Shuttle Ku-Band signal spectrum was reported at White Sands. Coincident with this distortion data loss on the Ku-Band channel 2 OPS recorder data (and less frequently on Ku-Band channel 1 OPS data) was reported while TV was being downlinked on channel 3. These symptoms are similar to conditions produced by overmodulation of the Ku-Band channel 2 OPS recorder data by the channel 3 TV.

Postmission testing at KSC could not exactly reproduce this condition; however, the frequency stability of the Ku-Band signal processor assembly (SPA) intermediate frequency (IF) output was not within specification. CONCLUSION: Further investigation is required to determine if overmodulation is the cause of the problems observed on STS-46. The out-of-specification condition on the SPA IF will also be investigated. CORRECTIVE_ACTION: The SPA was removed and will be sent to JSC ESTL for further evaluation using a CCTV system to simulate the Orbiter environment. Further analysis and subsequent corrective action will be tracked on CAR 46RF08. Data will continue to be gathered from future flights. Ground stations have been set up to collect data in the event that the problem recurs. EFFECTS_ON_SUBSEQUENT_MISSIONS: Channel 1 OPS data is not affected by this problem since the OPS data is primarily downlinked on the S-Band system. Ku-Band channel 2 OPS recorder data can be resent if data dropouts occur.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 007:23:38:11.989	Problem	**FIAR**	**IFA** STS-46-V-11	RCS
PROP-02	**GMT:** 221:13:35:00.000		**SPR** None	**UA**	**Manager:**
			IPR TBDV-0013	**PR**	
					Engineer:

Title: Manifold 5 LRCS Valves Failed to Cycle (ORB)

Summary: DISCUSSION: During the nominal postlanding redundant circuit verification, the talkback for the left reaction control system (RCS) manifold 5 isolation valves remained "open" when the crew attempted several times to close the valves. A review of the telemetered data indicated that the remote power controller (RPC) power indication was received, however, the valve position indications showed the isolation valves remained in the open position.

The cause of the anomaly was immediately suspected to be the the circuit breaker. Therefore, at the request of the Mission Evaluation Room (MER), the ground technicians were asked to verify the position of the circuit breaker (cb 71) upon entering the vehicle. The ground technician visually verified that the circuit breaker was closed. At that time, the valve switch was cycled to closed and back to open. All data both on-board and telemetered was nominal. Additional troubleshooting consisted of cycling the valves several more times and the anomaly did not repeat. The left orbital maneuvering system (OMS) pod (LP01) will be removed for the Orbiter maintenance down period (OMDP). Upon reinstallation of the OMS pod, normal turnaround testing will provide additional checkout of the valve circuit. CONCLUSION: The most probable cause of the anomaly is contamination at the circuit breaker. This is a low-current circuit and contamination has caused problems similar to this in the past. Clearing contamination typically requires cycling the circuit breaker several times, although in this case, the circuit breaker was not cycled. CORRECTIVE_ACTION: None. Troubleshooting was completed and the valves functioned nominally. Normal turnaround testing following reinstallation of the OMS pods will be performed. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 006:20:27:11.989	Problem	**FIAR**	**IFA** STS-46-V-12	GN&C
None	**GMT:** 220:10:24:00.000		**SPR** 46RF07	**UA**	**Manager:**
			IPR TBDV-0018	**PR**	
					Engineer:

Title: Left Air Data Probe Temperature Discrepency (ORB)

Summary: DISCUSSION: During the flight control system (FCS) checkout (OPS 8) on STS-46, the two air data transducer assemblies (ADTAs) on the left air data probe (LADP) had temperature readings that differed by 4.5?C before and after self-test. Self-test temperature data tracked nominally. This anomaly did not violate any requirements, but is close to the Launch Commit Criteria (LCC) GNC-75 limit of 5?C. Prelaunch (OPS 9) and entry (OPS 3) temperatures appeared to track correctly. The

flight configuration for STS-46 consisted of three "old build" ADTAs in slots 1, 2, and 4, with slot 3 being a new ADTA taken from OV-105, resulting in a new ADTA and an old ADTA on the LADP.

Postflight, a temperature test was conducted during which the probes were cooled to -5?C and warmed to almost 140?C. The ADTA temperature discrepancies were repeated in the temperature range seen in the FCS checkout (~4.3?C) and also at other temperatures to a lesser extent. The temperature data output on the new ADTA stuck at certain points and then released and tracked the old ADTA temperatures when the problem range was passed. The electrical connectors to ADTAs 1 and 3 were exchanged in an attempt to isolate the problem to the probe temperature sensor or the ADTA. ADTA 3 again displayed the sticking, indicating that the anomaly is in the new ADTA (3), serial number 747. The anomaly was not noted during the STS-46 entry because the temperatures change rapidly during entry, and this makes it difficult to observe the temperature data sticking. In reviewing entry data from STS-46 and STS-49 (OV-105, three new ADTAs, one old ADTA), and STS-47 (same configuration as STS-49), all of the new ADTAs showed temperature data sticking for short periods of time at several discrete temperatures. The old ADTAs behave erratically to a smaller extent in these same temperature ranges, a fact which was not known previously. The temperature data from the ADTA are not used in the flight control system but are used for health monitoring of the hardware. The pressure data from the ADTAs during all the missions were nominal. Testing under CAR 46RF-07 is planned at the vendor to analyze the temperature circuit on a newly built analog-to-digital conversion card inside the ADTA. This circuit card is the prime suspect for the cause of the temperature anomaly. CONCLUSION: Flight data and postflight data indicate that the problem is generic to the newly-built ADTAs. The suspect area is the analog-to-digital conversion circuitry internal to the ADTA. This problem is not a constraint to flight. CORRECTIVE_ACTION: Failure analysis continues at the vendor. In addition, LCC GNC-75 is being readdressed. EFFECTS_ON_SUBSEQUENT_MISSIONS: None. The problem affects only the temperature data, which are not used by the onboard guidance, navigation, and control software. Temperature data are only used to determine the health of the ADTAs.